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The goal of the research is to better use the high bandwidth potential of optical fiber by accomplishing the usually electronics based functions of input, output, regeneration, noise suppression, and synchronization in optics. A simple system that exhibits these features is an optical buffer or "memory". The memory supports insertion and readout of full packets by means of a gap between packets. Amplification is done using a semiconductor optical amplifier (SOA), and noise reduction is accomplished by a loop mirror containing an SOA as a nonlinear element. Synchronization is approached through gain modulation of the SOA.

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# FINAL REPORT

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## 1/7/95-6/30/98

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The goal of the research is to better use the high bandwidth potential of optical fiber by accomplishing the usually electronics based functions of input, output, regeneration, noise suppression, and synchronization in optics. A simple system that exhibits these features is an optical buffer or "memory". The memory supports insertion and readout of full packets by means of a gap between packets. Amplification is done using a semiconductor optical amplifier (SOA), and noise reduction is accomplished by a loop mirror containing an SOA as a nonlinear element. Synchronization is approached through gain modulation of the SOA.

Parts of the system have been tested in the laboratory and simulation models have been based on the experiments. A simulation system and user interface has been implemented in C++ for individual components. An analysis of the evolution of ones and zeroes in the system has been attempted. This problem is not very tractable when approached from first principles, and the research indicates that engineering models based on experiment will be a more fruitful approach to the problem. The effect of timing jitter on system performance is another difficult analytical problem, and may be better addressed by partially empirical models. Interesting questions have been uncovered concerning the combining of models for individual components into a simulator for the closed feedback memory system. Concerns about the stability of the closed loop memory have arisen and have not been analytically tractable.